

## WHAT IS CLAIMED IS:

1                   1.       An alloy carbon steel comprising iron and a maximum of 0.35% by  
2 weight of carbon, said alloy carbon steel having a triple-phase microstructure comprising  
3 ferrite crystals fused with martensite-austenite crystals, said martensite-austenite crystals  
4 comprising laths of martensite alternating with thin films of austenite.

1                   2.       An alloy carbon steel in accordance with claim 1 in which said  
2 martensite-austenite crystals are devoid of carbide precipitates at interfaces between  
3 phases.

1                   3.       An alloy carbon steel in accordance with claim 1 in which  
2 martensite-austenite crystals constitute from about 5% to about 95% by weight of said  
3 triple-phase microstructure.

1                   4.       An alloy carbon steel in accordance with claim 1 in which said  
2 martensite-austenite crystals constitute from about 15% to about 60% by weight of said  
3 triple-phase microstructure.

1                   5.       An alloy carbon steel in accordance with claim 1 in which said  
2 martensite-austenite crystals constitute from about 20% to about 40% by weight of said  
3 triple-phase microstructure.

1                   6.       An alloy carbon steel in accordance with claim 1 in which said  
2 carbon constitutes from about 0.01% to about 0.35% by weight of said triple-phase  
3 microstructure.

1                   7.       An alloy carbon steel in accordance with claim 1 in which said  
2 carbon constitutes from about 0.03% to about 0.3% by weight of said triple-phase  
3 microstructure.

1                   8.       An alloy carbon steel in accordance with claim 1 in which said  
2 carbon constitutes from about 0.05% to about 0.2% by weight of said triple-phase  
3 microstructure.

1                   **9.**     An alloy carbon steel in accordance with claim **1** further  
2 comprising silicon at a concentration of from about 0.1% to about 3% by weight of said  
3 alloy composition.

1                   **10.**    An alloy carbon steel in accordance with claim **1** further  
2 comprising silicon at a concentration of from about 1% to about 2.5% by weight of said  
3 alloy composition.

1                   **11.**    An alloy carbon steel in accordance with claim **1** in which said  
2 carbon constitutes from about 0.03% to about 0.3% by weight of said triple-phase  
3 microstructure, said alloy carbon steel further comprising silicon at a concentration of  
4 from about 0.1% to about 3% by weight of said alloy composition.

1                   **12.**    An alloy carbon steel in accordance with claim **1** in which said  
2 carbon constitutes from about 0.05% to about 0.2% by weight of said triple-phase  
3 microstructure, said alloy carbon steel further comprising silicon at a concentration of  
4 from about 1% to about 2.5% by weight of said alloy composition, and containing  
5 substantially no carbides.

1                   **13.**    A process for manufacturing a high-strength, corrosion-resistant  
2 tough alloy carbon steel, said process comprising:

- 3                   (a)     forming an alloy composition comprising iron and at least one  
4                   alloying element comprising a maximum of about 0.35% by weight  
5                   of carbon in proportions selected to provide said alloy composition  
6                   with a martensite transition range having a martensite start  
7                   temperature of at least about 300°C;  
8                   (b)     heating said alloy composition to a temperature sufficiently high to  
9                   cause austenitization thereof, under conditions causing said alloy  
10                  composition to assume a homogeneous austenite phase with all  
11                  alloying elements in solution;  
12                  (c)     cooling said homogeneous austenite phase sufficiently to transform  
13                  a portion of said austenite phase to ferrite crystals, thereby forming  
14                  a two-phase microstructure comprising ferrite crystals fused with  
15                  austenite crystals; and

16 (d) cooling said two-phase microstructure through said martensite  
17 transition range under conditions causing conversion of said  
18 austenite crystals to a microstructure containing laths of martensite  
19 alternating with films of retained austenite.

1 14. A process in accordance with claim 13 in which step (d) comprises  
2 cooling said two-phase microstructure at a rate sufficiently fast to avoid the occurrence of  
3 autotempering.

1 15. A process in accordance with claim 13 in which step (d) comprises  
2 cooling said two-phase microstructure by contact of said two-phase crystal structure with  
3 water.

1 16. A process in accordance with claim 13 in which step (c) comprises  
2 cooling said homogeneous austenite phase to a temperature of from about 750°C to about  
3 950°C.

1 17. A process in accordance with claim 13 in which step (c) comprises  
2 cooling said homogeneous austenite phase to a temperature of from about 775°C to about  
3 900°C.

1 18. A process in accordance with claim 13 in which said carbon  
2 constitutes from about 0.01% to about 0.35% by weight of said alloy composition.

1 19. A process in accordance with claim 13 in which said carbon  
2 constitutes from about 0.03% to about 0.3% by weight of said alloy composition.

1 20. A process in accordance with claim 13 in which said carbon  
2 constitutes from about 0.05% to about 0.2% by weight of said alloy composition.

1 21. A process in accordance with claim 13 in which said alloy  
2 composition further comprises silicon at a concentration of from about 0.1% to about 3%  
3 by weight.

1 22. A process in accordance with claim 13 in which said alloy  
2 composition further comprises silicon at a concentration of from about 1% to about 2.5%  
3 by weight.